ORIGINAL ARTICLE

The analgesic efficacy of landmark-guided fascia iliaca compartment block with dexamethasone-bupivacaine in femoral fracture surgery under subarachnoid anaesthesia in resource-limited settings

[1]Muhammad ST, *[1]Yakubu H, [1]Yakubu SY, [2]Suleiman ZA, [3]Imarengiaye CO, [4]Hamza KL, [1]Idris ME, [1]Lawal II

[1]Department of Anaesthesia, Ahmadu Bello University/Ahmadu Bello University Teaching Hospital, Zaria, Kaduna State, Nigeria
[2]Department of Anaesthesia, University of Ilorin/University of Ilorin Teaching Hospital, Ilorin, Nigeria
[3]Department of Anesthesiology and Intensive Care, University of Benin/ University of Benin Teaching Hospital, Benin city, Nigeria
[4]Department of Community Medicine, Ahmadu Bello University/Ahmadu Bello University Teaching Hospital, Zaria, Kaduna State, Nigeria

ABSTRACT

Background: Femoral fractures often lead to severe pain especially during patient resuscitation, transfers, and positioning for anaesthesia. Fascia Iliaca Compartment Block (FICB) with bupivacaine offers excellent pain relief for this group of patients, but the analgesic effect might not last long enough for postoperative pain management.

Aim and Objectives: We evaluated the impact of adding dexamethasone to bupivacaine in FICB on the duration of analgesia, postoperative pain scores, opioid requirements and patient satisfaction among femoral fracture patients in North West Nigeria.

Patients and Methods: In this single-blind study, we randomly assigned 80 patients with femoral fractures, aged 18 to 80 years, scheduled for open reduction and internal fixation, into two groups. Group BD (40 patients) received a landmark-guided Fascia Iliaca Compartment Block (FICB) with 38 ml of 0.25% bupivacaine and 6 mg of dexamethasone (2 ml). Group B (40 patients) received a similar FICB with 38 ml of 0.25% bupivacaine and 2 ml of normal saline. Spinal anesthesia was administered 30 minutes after the FICB for surgical anesthesia. We compared the duration of analgesia, 24-hour tramadol requirements, and patient satisfaction between the two groups

Results: Group BD reported significantly lower pain scores at 4, 12 and 24 hours, and reduced 24 hours tramadol consumption compared to Group B. The Mean VAS score at 24 hours was 4.25±0.494 and 4.53±0.679 in groups BD and B respectively, p =0.042. Mean 24-hour tramadol consumption was 160±63.20mg for Group BD and 453±75mg for Group B, p=0.001. The duration of analgesia was also longer in Group BD: 20±2.40 hours vs. 8.38±1.82 hours, in group B; p=0.001. Eighty percent (80%) of patients in Group BD reported being "very satisfied" with the anaesthesia, while only 25% of patients in Group B expressed the same level of satisfaction. Notably, all of the patients in the study reported some level of satisfaction with the level of pain control achieved through FICB.

Conclusion: This study demonstrates that the addition of dexamethasone to bupivacaine for FICB effectively extends the duration of analgesia, reduces postoperative pain scores, and decreases opioid consumption. In addition, it gives better patient satisfaction compared to the use of bupivacaine only.

Key words: Single shot spinal, Bupivacaine, Pethidine, Fentanyl, labour analgesia.

Correspondence: Yakubu Hamisu, Department of Anaesthesia, Ahmadu Bello University Teaching Hospital, Zaria, Kaduna State, Nigeria
Email: drhamisuyakubu@yahoo.com,
Tel: +2348065951147

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INTRODUCTION

Fractures of the femur represent a common and challenging clinical scenario necessitating surgical intervention. These fractures can result from various factors, ranging from minimal trauma in the osteoporotic bones of elderly individuals to high-energy injuries, such as those sustained in road traffic accidents, among the younger population.[i,ii]

The management of femoral fractures typically involves surgical intervention, with the choice between open reduction and internal fixation (ORIF) or closed reduction and internal fixation (CRIF) depending on several factors including the location and type of fracture, the age of the patient, and whether the fracture is open or closed. In cases where surgery is not a viable option due to medical contraindications, non-operative treatment is the option.[iii]

Femoral fractures are often associated with severe and excruciating pain, primarily emanating from the femoral shaft periosteum and the spasm of the quadriceps muscle.[i] Also, the natures of these fractures, compounded by the overriding fracture-ends make it a challenging task to position these patients for neuraxial blocks.[i] Postoperative pain which can be exacerbated by the movement of the operated leg is also a significant concern.[vi]

In this context, ensuring adequate and effective pain control plays a crucial role in mitigating the pathophysiological response to surgical stress, reducing postoperative complications, and enhancing patient satisfaction. Effective analgesia will enhance recovery through prompt mobilization and the timely initiation of physiotherapy which are vital steps that minimize postoperative morbidity and mortality in patients with lower limb fractures.[4,vii]

A range of modalities, including the use of non-steroidal anti-inflammatory drugs (NSAIDs), opioids, 3-in-1 femoral nerve blocks, and fascia iliaca compartment blocks (FICB), are available to address perioperative pain in patients with femoral fractures.[8,9,10,11]

However, many of these modalities are associated with adverse effects: NSAIDs potentially lead to gastrointestinal hemorrhage and renal function derangement, while parenteral opioids cause respiratory depression, hypotension, dizziness, mental confusion, constipation, itching, urinary retention, nausea, and vomiting. In contrast, peripheral nerve blocks are devoid of the aforementioned side effects, and offer several advantages such as fewer autonomic side effects, less motor blockade, reduced risk of neurological complications and the option of a unilateral block. Fascia iliaca compartment blocks with bupivacaine, in particular, have been shown to provide effective analgesia for femoral fractures with minimal systemic effects. [i,ii,iii,iv]

Despite being volume-dependent, FICB is characterized by its safety, simplicity, and efficacy. This technique involves the injection of local anesthetic beneath the fascia iliaca, which encapsulates the lateral cutaneous, femoral, and obturator nerves.[5,12,13,14,15] However, one notable limitation of bupivacaine-only FICB is its limited duration of analgesia, which restricts its postoperative benefits. Various adjuvants, such as adrenaline, clonidine, opioids, ketamine, and midazolam, have been explored to extend the duration of analgesia, with varying degrees of success. The use of dexamethasone as adjuvant to bupivacaine in FCIB has shown promise in prolonging the duration of nerve blocks, as evidenced by several clinical studies.[5,i,ii,iii,iv] Yet, limited research has been conducted within the West African sub-region to examine the postoperative analgesic effects of dexamethasone as an adjunct to bupivacaine for FICB.

Therefore, this study aims to evaluate the analgesic efficacy of the use dexamethasone with bupivacaine in fascia iliaca compartment blocks for patients undergoing open reduction and internal fixation of femoral fractures under spinal anesthesia in resource limited settings.

PATIENTS AND METHODS

Following an institutional ethical committee approval, and written informed consent from patients, this prospective single-blind randomized study was carried between October, 2018 and October, 2019. Eighty patients, of ASA class I – III, aged 18 – 80 years old with femoral fracture that consented to open-reduction and internal fixation (ORIF) under spinal anaesthesia were enrolled. Patients with allergy to amide local anaesthetics, peripheral neuropathy, bleeding diathesis, previous femoral artery bypass surgery, inguinal hernia, infection at injection site, morbid obesity (BMI ≥40), cognitive impairment, multiply injury and impaired consciousness were excluded from this study.

A total of 80 patients were recruited for the study. They were randomized into two groups: Bupivacaine (B) and Bupivacaine-Dexamethasone (BD) by consecutive alternate allocation, serially according to the surgical lists.

In the operating suite, baseline vital signs were recorded. Thereafter, NIBP was measured at 5-minutes interval while PR, SPO_2 and ECG were monitored continuously prior to FICB and throughout the duration of surgery.

Patients in group BD had FICB with 38ml of 0.25% plain bupivacaine mixed with 2mL of dexamethasone (6mg), while group B received 38ml of 0.25% plain

bupivacaine with 2mL of normal saline, before subarachnoid block (SAB).

Procedure

The landmark technique of FICB used in this study was as described by Dalens et.al.[i]

The patients were positioned supine, with lower extremity slightly abducted and externally rotated (where possible). A line was drawn on the skin from anterior superior iliac spine to the pubic tubercle. Needle insertion point was 1cm caudal to the junction between lateral and middle third of the line. Under aseptic precautions, the skin was infiltrated with 1% lidocaine and a stimuplex needle, size 22G 100mm long, blunt-tipped "bullet-type" was used to perform the block. The skin was pierced at right angle to its surface. Identification of the compartment was based on perception of two "gives" followed by a loss of resistance; the first "give" felt was the fascia lata and the second "give" was the fascia iliaca. With the needle in place, 40ml of the different study solutions were injected in 5mL aliquots after negative aspiration to exclude intravascular injection in the two groups.

Spinal anaesthesia was established 30 minutes after the FICB with 3mls of 0.5% heavy bupivacaine (Marcaine^{R}) plus 25ug of fentanyl. Patients were then positioned for surgery per institutional protocol.

Pain assessment

Pain severity was assessed using visual analogue scale (VAS). The VAS score was recorded on movement (sitting up for spinal block procedure) at 30minute after the FICB (zero minutes for the study), then 4hourly for the next 24hours. A VAS score of <4 at 30min post FICB was considered as a successful onset of the block.[12]

Postoperative analgesia was provided with intravenous paracetamol 1000mg 6hourly, and intramuscular diclofenac 75mg 12hourly in both groups. Rescue analgesia was provided with intramuscular tramadol 100mg, PRN or when pain score of ≥ 4 was recorded and not less than 4hours from the previous dose. The side effects and possible complications of SAB, FICB and tramadol, as well as features of local anaesthetic systemic toxicity were looked out for and treated per protocol.

Hypotension, defined as mean arterial blood pressure of greater than 20% decrease in baseline values, was managed with an IV bolus of 250ml of normal saline and 6mg of ephedrine, repeated PRN. Bradycardia, defined as heart rate of less than 60 beats per minute or more than 25% decrease in baseline values was treated with IV atropine 0.6mg, repeated bolus d oses.

Duration of analgesia was measured as the time from institution of FICB to the time of first rescue analgesic request. Means of duration of analgesia, pains scores at 4hourly interval and total 24hour tramadol consumption as well as patient satisfaction were measured and compared.

RESULTS

Of the 80 patients recruited for this study, sixty five percent were males while 35% were females. The mean ages were similar in the two groups: 41.3 ± 15.8 versus 40.7 ±15.5 years in groups B and BD respectively, p=0.864. (Table 1). All the patients in the bupivacaine-dexamethasone (BD) group had elective surgery while 17.5% of the patients in group B had emergency surgery,

Table 1: Demographic data and clinical characteristics of patients in the study groups

Variables	Group BD, N (%)	Group B N (%)	P-value
Age (yrs)			
Mean ±SD	41.28±15.72	40.68±15.51	0.864
Gender			
Male	25 (62.5)	27 (67.5)	
Female	5 (37.5)	13 (32.5)	
Surgery			
Elective	40 (100)	33 (82.5)	
Emergency	0 (0)	7 (17.5)	

In Table 2, the mean duration of analgesia (Time to first request of tramadol) was significantly longer (P = 0.001) in group BD (20.0 ± 2.4 hours) compared to group B (8.34±1.8 hours). Also, there was a significant difference (P= 0.001) between the groups in the mean total 24 hours tramadol consumption; being 160±63.20mg and 453±75 in groups BD and B respectively.

Table 2: Mean duration of analgesia and 24hour opioid consumption in the two study groups

Group	DB	Group B	P values
Duration of analgesia (Hours)	20.00±2.40	8.38±1.82	0.001
24 hour tramadol consumption (mg)	160±63.20	453±75	0.001

According to Table 3, the VAS pain score observed 30 minutes after FICB (zero minutes) was similar in the two study groups, p= 0.329. However, the mean VAS scores were significantly lowered in group BD compared to B when measured at 4, 8, 12, 16, and 20 hours,(p=0.001). The mean VAS score at 24hrs after the fascia iliaca compartment block was also lower in group BD, P=0.042 (Table 3).

Table 3: Quality of analgesia (mean pain scores) between the two groups over 24 hours after FICB

Time	**VAS Scores** Group BD	Group B	Mean difference	95% C.I.		P-value
0 minutes (30min after FICB)	2. 98±1.51	2.68±1.21	0.300	0.309	0.909	0.329
4 hours	0.00±0.00	0.43±0.59	-0.425	0.612	0.238	0.001
8 hours	0.20±0.516	3.20±1.181	-3.000	3.406	2.594	0.001
12 hours	1.05±0.639	4.00±0.555	-2.950	3.216	2.684	0.001
16 hours	2.15±0.622	4.15±0.533	-2.000	2.258	1.174	0.001
20 hours	3.53±0.679	4.35±0.58	-0.825	1.106	0.544	0.001
24 hours	4.53±0.679	4.25±0.494	0.275	0.011	0.539	0.042

With regards to patient satisfaction, all the patients in both study groups expressed some level of satisfaction with the postoperative pain management offered them with 80% and 25% of the patients in groups DB and B respectively being "very satisfied" with the FICB. None of the patients in the study expressed non-satisfaction with the block. (Table 4).

Table 4: Patient satisfaction with FICB in the BD and B groups

Level of Satisfaction	Study group N (%)	Control group N (%)
Very satisfied	32 (80)	10 (25)
Satisfied	8 (20)	30 (75)
Not satisfied	0(0)	0(0)
Total	40 (100)	40 (100)

DISCUSSION

This study demonstrates that the addition of 6mg of dexamethasone to bupivacaine for FICB in patients with femoral fractures undergoing ORIF significantly prolongs the duration of postoperative analgesia, reduces the need for postoperative opioid analgesics, and improves patient satisfaction.

The duration of analgesia was more than doubled in the bupivacaine-dexamethasone group compared to the bupivacaine-only group. This finding is consistent with previous studies, which have also shown that the addition of dexamethasone to local anesthetics can significantly prolong the duration of analgesia. For example, Sana and colleagues[i] observed increased duration of analgesia when dexamethasone was added

to bupivacaine and dexmedetomidine in FICB for patients undergoing surgery for proximal femoral fractures. Similarly, Suresh and colleagues[5] demonstrated that dexamethasone can increase the duration action of bupivacaine in FICB by at least 1.5-2 times that of bupivacaine alone. Acharya and colleagues,[15] found similar results when studying the effects of adding dexamethasone to levobupivacaine in FICB.

Our study also found that the Visual Analog Scale (VAS) pain scores, 30 minutes after establishing FICB, were similar between the two groups, possibly due to the effects of the intervention. However, subsequently, the VAS scores at 4, 8,12,16,20, and 24 hours post-block were significantly lower in the dexamethasone group. Other studies reported similar initial insignificant differences in VAS pain scores but noted significant benefits with the addition of dexamethasone, reinforcing the consistency of dexamethasone's analgesic effects.[5.15.17]

Furthermore, our study revealed that patients in the bupivacaine-dexamethasone group required significantly less rescue analgesia. This finding is consistent with previous studies, which have shown that the addition of dexamethasone to local anesthetics can reduce the need for postoperative opioid analgesia. For example, Callear and others9 noted reduced postoperative pain severity and fewer rescue analgesia administrations in the dexamethasone-bupivacaine group. Similar observations were made by Obideyi and other authors, indicating a reduction in rescue analgesia requirements, prolonged analgesia, and decreased opioid use when dexamethasone is added to bupivacaine for FICB.

Additionally, our study did not record any complications, aligning with previous findings that FICB is generally a safe block.[5.9.11.15.17.18]

Patients in this study expressed a high level of satisfaction, which is consistent with the findings of a previous research.[11] The addition of dexamethasone to bupivacaine may contribute to this satisfaction by producing denser and longer block. Additionally, the absence of common side effects associated with systemic opioid analgesics likely contributed to the observed high patient satisfaction.

One of the key advantages of landmark-guided FICB is that it can be performed without the need for ultrasound guidance, making it a more accessible and affordable option, particularly in resource-limited settings, one of which is this study centre. Several studies have also demonstrated the efficacy of landmark-guided FICB in providing effective postoperative pain relief.[xviii.xix.xx]

It is important to note that the success of landmark-guided FICB relies heavily on the operator's skill and experience. However, with proper training and practice, this technique can be reliably performed, even in settings where ultrasound machines are unavailable like ours, or unaffordable.

CONCLUSION

In conclusion, this study demonstrates that the addition of dexamethasone to bupivacaine for landmark-guided FICB is a safe and effective strategy for improving postoperative pain management in patients undergoing femoral fracture surgery, particularly in resource-limited settings.

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